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DRAWINGS ATTACHED

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(19)

(54) ELECTRICAL APPARATUS

(71) We, SULZER BROTHERS LIMITED, a Company organised under the Laws of Switzerland, of Winterthur, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to electrical apparatus which is suitable for exposure, at least transiently, to elevated pressures and is in physical contact with a corrosive medium.

Such apparatus includes motors for driving pumps and agitators, and the motors may be constructed as so-called "canned" motors and the rotor, as well as the stator, may be in physical contact with the corrosive medium which is being conveyed.

The invention may also be used in connection with electrical measuring apparatus, in particular inductive flowmeters, if the medium to be measured is a corrosive electrically conductive medium.

In all electrical apparatus of this kind, whose electrical structural parts are exposed, at least temporarily, to pressures exceeding one atmosphere, for example 10 or even 1000 atmospheres, it is necessary for structural parts endangered by corrosion, in particular the electrical conductors, to be protected against the corrosive pressurised medium.

According to the present invention electrical apparatus suitable for exposure, at least transiently, to elevated pressure and to be in physical contact with a corrosive medium includes a housing, a stationary electrical winding in the housing, a solidifying compound filling the voids in the housing completely, a gas-tight seal in an opening in the housing which seal contains the winding leads, and a gas-tight closure closing an additional opening for the admission of the compound to the housing and through which no winding leads pass, the housing totally enclosing the winding and the compound from all directions.

As the opening for the leads is separated frm the opening for the solidifying compound, it is possible for a sealing member in which the leads are embedded to be joined in a fluid-tight manner to the housing before the solidifying compound is introduced so that when the opening for the solidifying compound is sealed the housing is completely sealed from the atmosphere. This overcomes the disadvantage of arrangements in which the leads and the compound are introduced through the same inlet opening and hair-line cracks tend to develop along the leads thus admitting corrosive liquid if the pressure is reduced to atmospheric pressure.

Curable synthetic resins such as epoxy resins may be used as the solidifying compound so that any cavities which may occur during the pouring operation will not have any detrimental effects. To improve the pressure stability of the solidifying compound, solid particles such as quartz sand, powder or chips, may be added to the compound. Thermoplastic substances as for example, wax, may be used as solidifying compound.

If the electrical apparatus is an inductive flowmeter, it is possible for the leads extending to the measuring electrodes to be passed in gas-tight manner through further openings in the housing in a manner analogous to that of the leads to the electric winding or windings.

The invention may be carried into practice in various ways and two embodiments and a modification will now be described by way of example with reference to the accompanying drawings, of which:

Figure 1 is a longitudinal section through a "canned" motor;

Figure 2 is a modification of the closure member used with the embodiment of

[*Price 25p*]

Figure 1; and

Figure 3 is a longitudinal section through an inductive flowmeter.

The "canned" motor shown in Figure 1 which may drive a pump for delivering a corrosive medium, for example ammonia, under high pressure is provided with a shaft 1 and a squirrel-cage rotor 2 mounted on the shaft. Copper bars 3, the ends of which are connected by end rings 4, are embedded in the rotor. The end rings 4 are separated from the corrosive medium by covers 5 which are welded to the rotor and which comprise corrosion-resistant non-magnetic material. A stator 6 having a winding 6*a* is surrounded by a gas-tight housing 7. The cylindrical external and internal shells 7*a* and 7*b*, of the housing as well as end covers 7*c* and 7*d*, are constructed of corrosion-resistant material. The gas-tight components of the housing may be joined to each other by welding or, in cases in which it is possible, by ring seals. The housing may be constructed of sheet steel, and it may be possible for at least certain parts of the housing, in particular the internal shell, to be constructed of a corrosion-resistant, pressure-tight plastics material.

The end cover 7*c* of the housing 7 has an opening 8 for the introduction of a solidifying compound 9. A socket 10 is welded in gas-tight manner to the cover.

The outer shell 7*a* is also provided with an opening 11 which is joined in gas-tight manner to a socket 12, for example, by means of welding. The opening 11 and the socket 12 are provided for the feed-through of the bare electrical leads 13 to the stator winding 6*a*.

The following procedure may be adopted in producing the housing 7. First, the socket 12 is welded into the opening 11 of the outer shell 7*a*. The bare electric leads 13 are introduced into the bores of a glass plug 14 which is then inserted into the socket 12. The closure member thus prepared is heated until the glass melts and intimately surrounds the leads 13. Subsequent cooling causes the glass plug 14 to solidify and the socket 12 to shrink to produce a gas-tight joint between the socket 12 and the glass plug 14. The stator 6 is then inserted into the housing 7 and the leads 13 are connected to the stator winding 6*a*. The housing is then completely assembled, that is to say all gas-tight parts are joined to each other.

The stator winding 6*a* may have been pre-impregnated by a synthetic resin. The solidifying compound is then introduced into the housing through the socket 10. The compound may be a synthetic resin such as an epoxy resin in the fluid state. Before being introduced into the housing it is possible for solid particles, for example quartz sand or quartz meal to be added to th solidifying compound to improve its compressive strength. It is also possible for the solid particles 9*a* to be poured in through the socket 10 and to vibrate the encapsulated stator in order to obtain a dense packing of the particles. When the level of the particles remains constant showing that no more particles can be packed in, the liquid synthetic resin is poured in to fill the voids between the particles. After the synthetic resin has set, the opening 8 is closed in gas-tight manner as follows: The solidifying compound fills part of the socket 10, and the surface of the compound in the socket 10 is milled smooth and a disc 15 of insulating material, thermally resistant to the ensuing welding operation, is placed on the surface. A metallic, corrosion-resistant plug 16 is then inserted into the socket and is welded to it in a gas-tight manner. The housing 7 is then safely sealed relative to the atmosphere. It should be noted that the solidifying compound itself need not comprise a substance which is corrosion-resistant relative to the corrosive medium because owing to the hermetic seal the compound does not come into contact with the corrosive medium at any point.

In the modification shown in Figure 2, a closure member 16*a*, the upper part of which terminates in a cover 10*c* extending beyond the socket 10*a*, is screwed into the socket 10*a* which has a screw thread 10*b*. A gas-tight joint is produced between the closure member and the socket by means of a ring seal 17 of corrosion resistant material. For the gas-tight feed-through of the electric leads 13 a plug of a ceramic material may be used in place of the glass plug 14. A pipe is connected to the socket 12 in a detachable gas-tight manner in the interests of simple installation and dismantling. The pipe, in which any desired pressure may be maintained, is filled with gaseous, liquid or solid protective media, for example, paraffin oil, paraffin wax or polyethylene wax. The protective medium is so selected that it has no corrosive effect on the leads and cannot be attacked by the ambient medium.

Figure 3 shows an inductive flowmeter for a corrosive medium. A corrosive fluid medium, for example, effluent, flows through a duct 20 in the direction of the arrow. The electro-magnets 21 and 22 produce a homogeneous field in the electrically conductive fluid. The field induces a voltage between the measuring electrodes 23 and 24 which are disposed at an angle of 90° to the electro-magnets, the voltage being a measure of the flowrate of the medium. The electro-magnets 21 and 22, as well as the measuring electrodes 23 and 24 which extend through the housing wall 7*b* by being in-

sulated through measuring tubes 23*a* and 24*a*, are isolated from the corrosive medium by a hermetically closed housing similar to that shown in Figure 1. Like elements are given th same reference numerals as those in Figure 1.

The out r shell 7*a* of the housing is provided with two additional openings 25 and 26 through which are fed the conductors 27 and 28 to the measuring electrodes. By analogy with the feed-through of the leads to the electro-magnets, and bare conductors 27 and 28 are each inserted into a glass plug 29 and 30 which are joined to the sockets 32 and 31 with their outer surfaces flush. The various possible constructions described with reference to Figures 1 and 2 for closing the various openings also applies to Figure 3.

WHAT WE CLAIM IS:—

1. Electrical apparatus suitable for exposure, at least transiently, to elevated pressure and to be in physical contact with a corrosive medium, the apparatus including a housing, a stationary electrical winding in the housing, a solidifying compound filling the voids in the housing completely, a gas-tight seal in an opening in the housing which seal contains the winding leads, and a gas-tight closure closing an additional opening for the admission of the compound to the housing and through which no winding leads pass, the housing totally nclosing the winding and the compound from all directions.

2. Apparatus as claimed in Claim 1 in which the solidifying compound is a curable synthetic resin.

3. Apparatus as claimed in Claim 1 or Claim 2 in which the solidifying compound is a thermoplastics material.

4. Apparatus as claimed in Claim 1 or Claim 2 or Claim 3 in which the housing contains solid particles in addition to the solidifying compound.

5. Apparatus as claimed in any of the preceding Claims in which the housing has further openings admitting leads to additional electrical equipment in a gas-tight manner.

6. Electrical apparatus substantially as specifically described herein with reference to Figure 1 or Figure 3 of the accompanying drawings.

7. Apparatus as claimed in claim 6 modified as specifically described herein with reference to Figure 2 of the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
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Fig.1

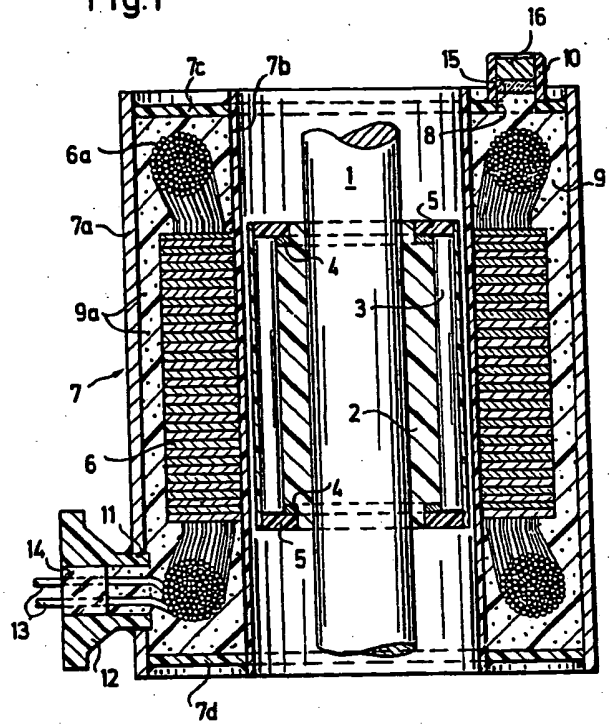


Fig.2

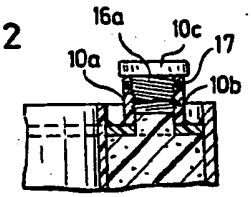
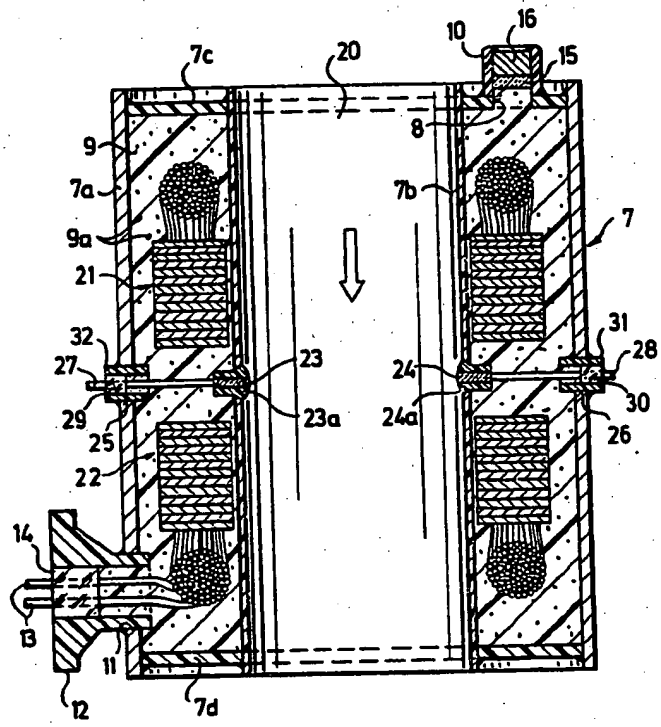


Fig. 3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